UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/988,686	12/11/1997	ANTHONY J. KONECNI	TI-22166	7837

23494 7590 07/17/2002

TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER
WILCZEWSKI, MARY A

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 07/17/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER OF
PATENTS AND TRADEMARKS
Washington, D.C. 20231

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 26

Application Number: 08/988,686
Filing Date: December 11, 1997
Appellant(s): Anthony J. Konecni et al.

Jay M. Cantor
For Appellant

EXAMINER'S ANSWER

This is in response to appellant's brief on appeal filed May 22, 2001.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is substantially correct. The changes are as follows: The rejection of claims 21-32 under 35 U.S.C. 112, second paragraph, has been withdrawn.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 21-32 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

6,008,139	Pan et al.	12/1999
JP 4-171744	Masanori	06/1992

Takeyasu et al., "Characterization of Direct-Contact Via Plug Formed by Using Selective Aluminum Chemical Vapor Deposition", Japn. J. Appl. Phys., Vol. 33 (1994), pp. 424-428.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 21-26, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masanori, JP 4-171744, in view of Takeyasu et al., the article entitled "Characterization of Direct-Contact Via Plug Formed by Selective Aluminum Chemical Vapor Deposition".

Masanori discloses a method of fabricating an electronic device comprising the steps of forming a first electrically conductive structure comprising aluminum 3; forming an insulating layer 4 extending above the first electrically conductive structure, the insulating layer having an opening with sidewalls and a bottom exposing a portion of the first electrically conductive structure; providing a gas comprising argon and hydrogen incorporated within a plasma into the opening to remove a denatured layer formed on the first electrically conductive structure; then deposing a conductive material comprising aluminum 5 into the opening by Chemical Vapor Deposition (CVD).

Masanori does not disclose that the conductive material deposited into the contact opening is deposited by Chemical Vapor Deposition (CVD). However, Takeyasu et al. disclose a method of forming multi-layered interconnections having both the lower and upper conductive layers comprising aluminum wherein an aluminum plug is formed in the contact hole by selective CVD after a cleaning step is performed, see the abstract and Fig. 1(b). The method of Takeyasu et al. is low cost and yields a high performance interconnection with low via resistance, therefore, it would have been obvious to one skilled in the art that the Al/Al direct-contact via structure of Takeyasu et al. could have been substituted for the upper

aluminum layer of Masanori. The via structure of Takeyasu et al. also ensures complete filling of the via.

Masanori et al. disclose that other rare gasses can be used in place of argon. Therefore, it would have been obvious to one skilled in the art to use helium in the known method of Masanori et al.

The plasma power of about 150 watts to about 450 watts is a processing parameter which would have been obvious to optimize. The power at which a plasma is generated from is a well known processing variable and the discovery of the optimum or workable plasma power range involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed plasma power or any unexpected results arising therefrom. In any case, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed range of powers because applicant has not disclosed that these plasma powers are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using other powers. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Claims 27, 28, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over .Masanori, JP 4-171744, in view of Takeyasu et al., the article entitled "Characterization of Direct-Contact Via Plug Formed by Using Selective Aluminum Chemical Vapor Deposition", as applied to claim 21 above, and further in view of Pan et al., U. S. Patent 6,008,139.

Masanori et al and Takeyasu et al. are applied as above. Masanori et al. fail to disclose that the plasma has a bias power up to about 300 watts.

Pan et al. teach that a bias power of from about 20 to about 1000 watts is applied to a plasma used to etch a material in order to provide a more anisotropic and directional etch perpendicular to the surface of the substrate (column 6, lines 16-30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a bias to the plasma of Masanori et al. since, as taught by Pan et al., a biased etching plasma would provide a more anisotropic and directional etch perpendicular to the surface of the substrate thereby increasing the effectiveness at which the plasm gas is delivered to the surface of the conductive material at the bottom of the contact hole in the known method of Masanori et al. Furthermore, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular bias power recited in claims 27 and 28 because applicant has not disclosed that this bias power is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical, and it appears prima facie that the process would possess utility

using another bias power. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

(11) Response to Argument

As correctly pointed out by Appellant, the principal inventive feature set forth in the claims on appeal relates to the step of removing residue from an exposed portion of a conductive layer through an opening in an insulating layer by providing a halogen-free gas comprised of hydrogen incorporated within a plasma into the opening in the insulating layer and onto the exposed portion of the conductive layer to increase the reactive surface of the of any residual material on the exposed portion and at least partially remove the residual material. Appellant has incorrectly argued, however, that the Masanori patent applied in the rejection of the appealed claims uses a halogen-based chemistry to remove this residual material. Masanori refers to the residual material on the aluminum wiring layer as a denatured layer, see Figure 2. Masanori uses a plasma consisting of argon and hydrogen to clean the surface of the aluminum wiring exposed through a contact hole and remove this denatured layer. The plasma is clearly halogen-free, see the English-language abstract and page 280 of the document. The plasma consists of argon and hydrogen (H_2), although it is disclosed that other rare gases can be used in the plasma instead of argon. It is further disclosed that the hydrogen in the plasm combines with fluorine and oxygen in the denatured layer to form water (H_2O)and hydrofluoric acid

(HF). The end-products of the chemical reaction which results in the cleaning of the exposed portion of the aluminum layer by etching with the argon-hydrogen plasma are water and hydrofluoric acid, however, no gases containing a halogen are used in the plasma. Hence, it is the end-products of the chemical reaction which are halogen-containing and not the plasma itself. The claims, as presently drafted, do not preclude the removed residual material from being halogen-containing. Masanori clearly teaches a non-halogen chemistry for removing a denatured layer formed on the surface of an aluminum wiring.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

M. Wilczewski

MW

December 6, 2001

Conferees:

Olik Chaudhuri

Carl Whitehead